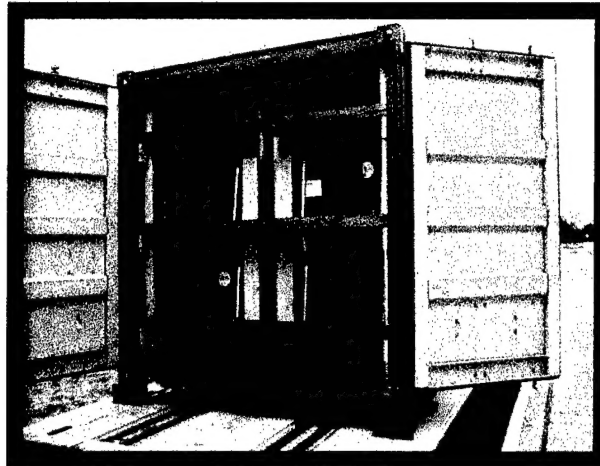


**FINAL REPORT
JANUARY 2004**

REPORT NO. 03-21



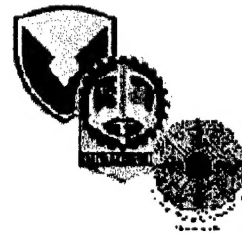
**TRANSPORTABILITY TESTING OF THE JOINT DIRECT
ATTACK MUNITION (JDAM) IN AN END-OPENING CONTAINER,
TP-94-01,
"TRANSPORTABILITY TESTING PROCEDURES"**

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REPORT NO. 03-21

**Transportability Testing of the Joint Direct Attack Munition (JDAM)
in an End-Opening Container,
TP-94-01, Revision 1, July 2002 "Transportability Testing Procedures"**

TABLE OF CONTENTS

PART	PAGE NO.
1. INTRODUCTION	1-1
A. BACKGROUND.....	1-1
B. AUTHORITY.....	1-1
C. OBJECTIVE	1-1
D. CONCLUSION	1-1
E. RECOMMENDATIONS.....	1-2
2. ATTENDEES.....	2-1
3. TEST EQUIPMENT.....	3-1
4. TEST PROCEDURES	4-1
A. RAIL TEST	4-1
B. ON/OFF ROAD TESTS.....	4-3
1. HAZARD COURSE	4-3
2. ROAD TRIP	4-4
3. PANIC STOPS.....	4-4
4. WASHBOARD COURSE	4-4
C. OCEAN-GOING VESSEL TEST.....	4-5
5. TEST RESULTS- TESTING DATE 2-8 DECEMBER 2003	5-1
A. RAIL TEST	5-1
B. ON/OFF ROAD TESTS	5-3
1. HAZARD COURSE.....	5-3
2. ROAD TRIP.....	5-4
3. PANIC STOPS.....	5-4
4. HAZARD COURSE	5-5
5. WASHBOARD COURSE.....	5-5
C. SHIPBOARD TRANSPORTATION SIMULATOR (STS)	5-6
D. CONCLUSION.....	5-5
6. DRAWINGS.....	6-1

REPORT NO. 03-21

JANUARY 2004

**TRANSPORTABILITY TESTING OF THE JOINT DIRECT ATTACK MUNITION
(JDAM) IN AN END-OPENING CONTAINER
TP-94-01, REV. 1, JULY 2002 "TRANSPORTABILITY TESTING PROCEDURES"**

ABSTRACT

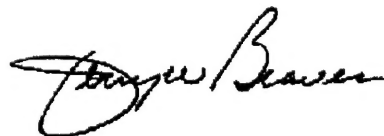
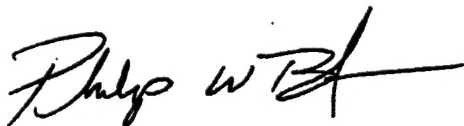
The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Transportation Engineering Division (SJMAC-DET) to conduct transportability testing of the Joint Direct Attack Munition (JDAM), Packed 2 Per CNU-589/E Shipping and Storage Container. The testing was conducted in accordance with TP-94-01, Revision 1, July 2003 "Transportability Testing Procedures."

The objective of the testing was to evaluate if the loading and bracing procedures for the Joint Direct Attack Munition (JDAM), packed 2 per CNU-589/E shipping and storage container could adequately restrain the load when transportability tested in accordance with TP-94-01, Revision 1, July 2002.

Based on the results of testing the loading and bracing procedures adequately restrained the ammunition load.

Prepared by:

Reviewed by:



PHILIP W. BARICKMAN
Lead Validation Engineer

JERRY W. BEAVER
Chief, Validation Engineering Division

PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Transportation Engineering Division (SJMAC-DET) to conduct transportability testing of the Joint Direct Attack Munition (JDAM), packed 2 per CNU-589/E shipping and storage container. The testing was conducted in accordance with TP-94-01, Revision 1, July 2003 "Transportability Testing Procedures."

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:

1. AR 740-1, 15 June 2001, Storage and Supply Activity Operation.
2. OSC-R, 10-23, Mission and Major Functions of U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

C. OBJECTIVE. The objective of the testing was to evaluate if the loading and bracing procedures for the JDAM, packed 2 per CNU-589/E shipping and storage container could adequately restrain the load when transportability tested in accordance with TP-94-01, Revision 1, July 2002.

D. CONCLUSION. The JDAM, packed 2 per CNU-589/E shipping and storage container load was tested in accordance with TP-94-01, Revision 1, July 2002. Based on the results of testing the loading and bracing procedures adequately restrained the ammunition load.

PART 2 - ATTENDEES

ATTENDEE

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PART 3 - TEST EQUIPMENT

1. Joint Direct Attack Munition (JDAM),
Packed 2 per CNU-589/E shipping and storage container
2. Truck, Tractor
5 Ton, 6 X 6
Model #: XM818 with winch
Manufactured by General Products Division, Jeep Corporation
ID #: 05A-74971-C124-13529
Weight: 20,955 pounds
3. Semitrailer, flatbed, breakbulk/container transporter, 22.5 ton
Model #: M871
Manufactured by Southwest Truck Body, St. Louis, MO
ID #: NX03PJ – 0063
NSN: 2330 00 122 6799
Weight: 15,630 pounds
4. Intermodal Container
ID # CMCU 200006-8
Date of Manufacture: 06/99
Manufactured by Charleston Marine Containers, Charleston, SC
Tare Weight: 4,870 pounds
Maximum Gross Weight: 67,200 pounds

PART 4 - TEST PROCEDURES

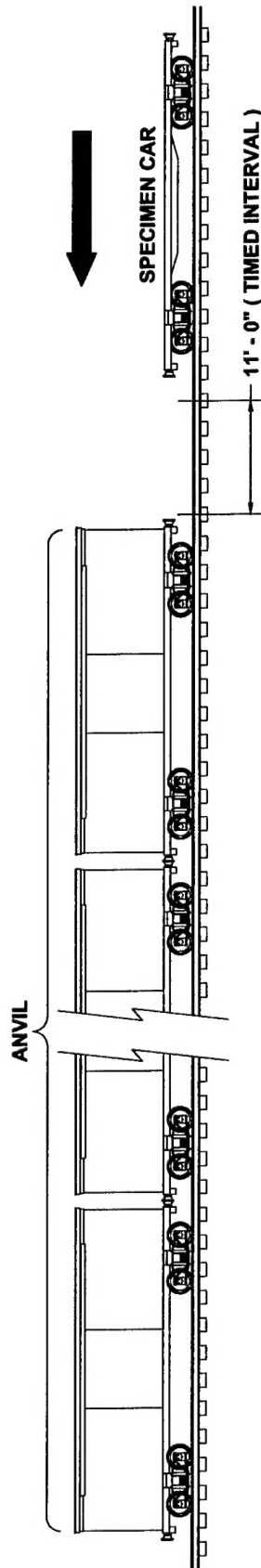
The test procedures outlined in this section were extracted from TP-94-01, Revision 1 "Transportability Testing Procedures," dated July 2002, for validating tactical vehicles and outloading procedures used for shipping munitions by tactical or commercial truck, railcar, and ocean-going vessel.

Inert (non-explosive) items will be used to build the load. The test loads will be prepared using the blocking and bracing procedures proposed for use with munitions (**see Part 6 for procedures**). The weight and physical characteristics (weights, physical dimensions, center of gravity, etc.) of the test loads will be similar to live (explosive) ammunition.

A. RAIL TEST. RAIL IMPACT TEST METHOD. The test load or vehicle will be secured to a flatcar. The equipment needed to perform the test will include the specimen (hammer) car, four empty railroad cars connected together to serve as the anvil, and a railroad locomotive. The anvil cars will be positioned on a level section of track with air and hand brakes set and with draft gears compressed. The locomotive unit will push the specimen car toward the anvil at a predetermined speed, then disconnect from the specimen car approximately 50 yards away from the anvil cars allowing the specimen car to roll freely along the track until it strikes the anvil. This will constitute an impact. Impacting will be accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The speeds will have a tolerance of plus .5 mph and minus zero mph. The impact speeds will be determined by using an electronic counter to measure the time for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars (see Figure 1).

ASSOCIATION OF AMERICAN RAILROADS (AAR)

STANDARD TEST PLAN



SPECIMEN CAR IS RELEASED BY SWITCH ENGINE TO ATTAIN:

- IMPACT NO. 1 @ 4 MPH
- IMPACT NO. 2 @ 6 MPH
- IMPACT NO. 3 @ 8.1 MPH

THEN THE CAR IS REVERSED AND RELEASED BY SWITCH ENGINE TO ATTAIN:

- IMPACT NO. 4 @ 8.1 MPH

4 BUFFER CARS (ANVIL) WITH DRAFT GEAR COMPRESSED AND AIR BRAKES IN A SET POSITION

ANVIL CAR TOTAL WT. 250,000 LBS (APPROX)

Figure 1. Rail Impact Sketch

B. ON/OFF ROAD TESTS.

1. HAZARD COURSE. The test load or vehicle will be transported over the 200-foot-long segment of concrete-paved road consisting of two series of railroad ties projecting 6 inches above the level of the road surface. The hazard course will be traversed two times (see Figure 2).

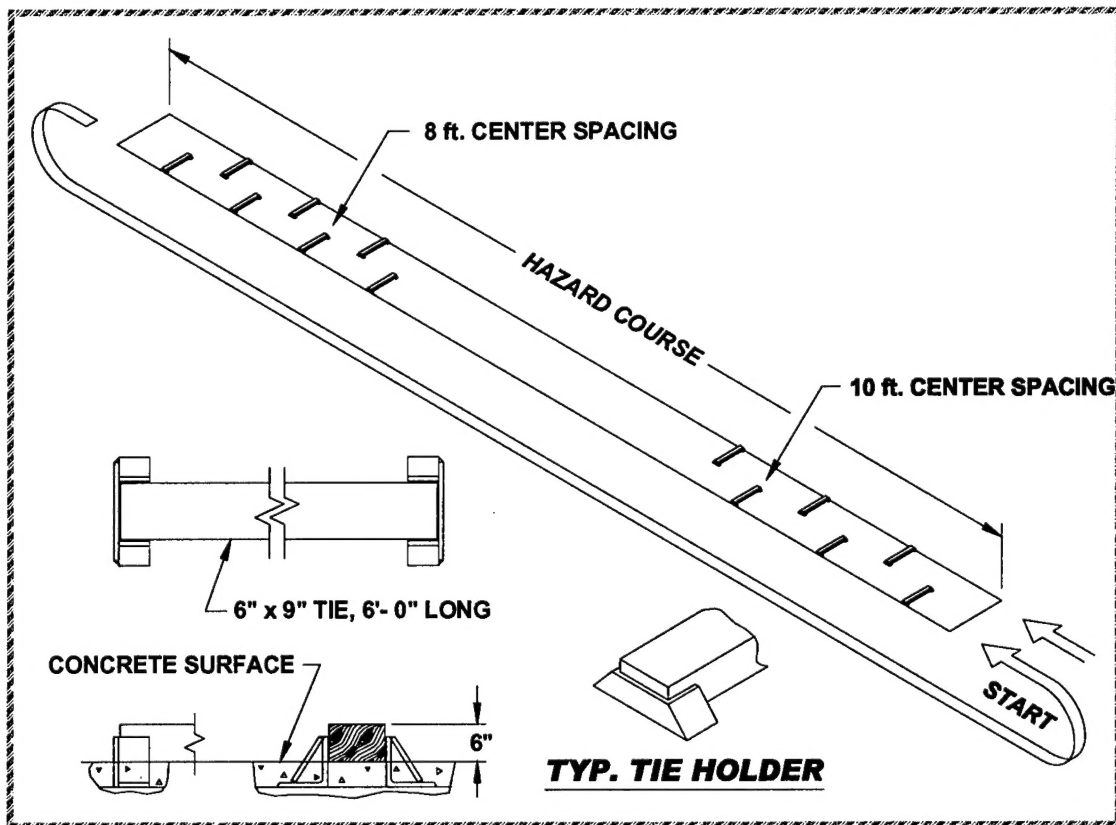


Figure 2. Hazard Course Sketch

- a. The first series of 6 ties are spaced on 10-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.
- b. Following the first series of ties, a paved roadway of 75 feet separates the first and second series of railroad ties.
- c. The second series of 7 ties are spaced on 8-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.

d. The test load is driven across the hazard course at speeds that will produce the most violent vertical and side-to-side rolling reaction obtainable in traversing the hazard course (approximately 5 mph).

2. **ROAD TRIP.** The test load or vehicle will be transported for a distance of 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. The test route will include curves, corners, railroad crossings and stops and starts. The test load or vehicle will travel at the maximum speed for the particular road being traversed, except as limited by legal restrictions.

3. **PANIC STOPS.** During the road trip, the test load or vehicle will be subjected to three (3) full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph while the stop in the reverse direction is approximately 5 mph. This testing will not be required if the Rail Impact Test is performed.

4. **WASHBOARD COURSE.** The test load or vehicle will be driven over the washboard course at a speed that produces the most violent response in the vertical direction.

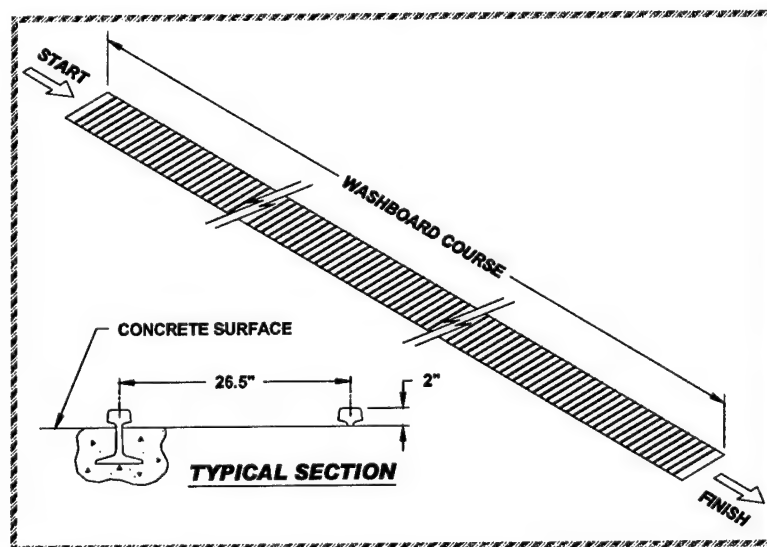


Figure 3. Washboard Course Sketch

C. OCEAN-GOING VESSEL TEST. SHIPBOARD TRANSPORTATION

SIMULATOR (STS) TEST METHOD. The test load will be secured inside an ISO container and will be positioned onto the STS and securely locked in place using the cam locks at each corner. Oscillation of the STS will be started and rotate to an angle of 30 degrees plus or minus 2 degrees, either side of center and at a frequency of 2 cycles-per-minute (30 seconds, plus or minus 2 seconds total roll period). This frequency will be observed for apparent defects that could cause a safety hazard. The frequency of oscillation will then be increased to 4 cycles-per-minute (15 seconds, plus or minus 1 second per roll period) and the apparatus operated a period of two (2) hours. An inspection of the load will then be conducted. If the inspection does not indicate an impending failure, the frequency of oscillation will be further increased to 5 cycles-per-minute (12 seconds, plus or minus 1 second-cycle time), and the apparatus operated for four (4) hours. The operation does not necessarily have to be continuous, however, no change or adjustments to the load or load restraints will be permitted at any time during the test. After once being set in place, the test load (specimen) will not be removed from the apparatus until the test has been completed or is terminated.

PART 5 - TEST RESULTS

Payload: Joint Direct Attack Munition (JDAM), Packed 2 Per CNU-589/E Shipping and Storage.

Testing Date: 2-8 December 2003

A. RAIL TEST.

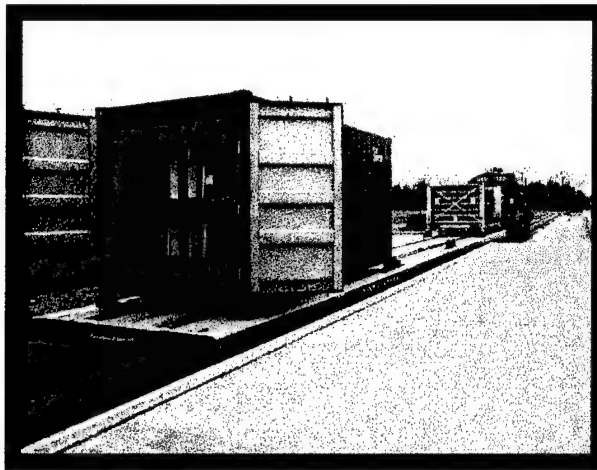


Photo 2. Rail Impact Testing of JDAM Load (Prior to Testing)

Description	Weight
Flatcar Number: DODX 42353	85,000 lbs.
JDAM Payload with Intermodal End Opening Container	13,300 lbs.
M1 Flatrack with MLRS Pods	28,265 lbs.
Total Specimen Wt.	126,565 lbs.
Buffer Car (four cars)	257,900 lbs.

Figure 4.

Remarks: Figure 4 lists the test components and weights of the items used during the Rail Impact Tests.

Impact Number	Avg. Velocity (mph)
1	4.4
2	6.2
3	8.2
4	8.2

Figure 5.

Remarks:

1. Figure 5 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impact #4 is the reverse impact.
2. Following Impact #4 the door post vertical moved .375 inches and the end blocking assembly moved 1.5 inches in the direction of impact.

B. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 3. Hazard Course Testing of the JDAM Load

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	29 Seconds	5.1
2	26 Seconds	5.7

Figure 6.

Remarks:

1. Figure 6 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Pass #1 revealed that the door post vertical moved .25 inches toward the rear of the trailer and the end blocking assembly moved toward the rear of the trailer 1.375 inches.
3. Inspection following Pass #2 revealed that the door post vertical moved .125 inches toward the rear of the trailer and the end blocking assembly moved toward the rear of the trailer .125 inches.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted following the Road Hazard Course Passes #2 and #3.
2. Following completion of the Road Trip inspection revealed that the end blocking assembly had moved .25 inches toward the driver's side.

3. PANIC STOPS: Testing was not required since the JDAM Load was rail impact tested.

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	26 Seconds	5.7
4	25 Seconds	5.9

Figure 7.

Remark: Figure 7 lists the average speeds of the test load through the Hazard Course.

5. WASHBOARD COURSE:

Remarks:

1. Inspection following the completion of the washboard course revealed that the end blocking assembly had moved toward the driver's side an additional .5 inches.
2. The top JDAM container on the driver's side moved .5 inches toward the passenger side.
3. The top universal load retainer rubbed against the container door on the driver's side.



Photo 4. Washboard Course Testing of the JDAM Load.

C. SHIPBOARD TRANSPORTATION SIMULATOR (STS).

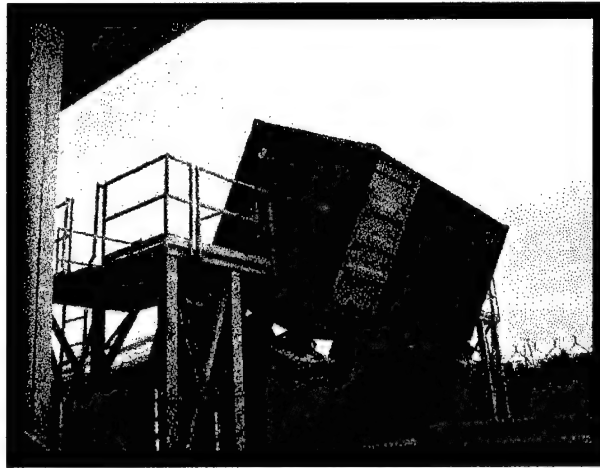


Photo 5. STS Testing of the JDAM Load.

Remark: Inspection following the completion of the testing showed that the JDAM containers slid .5 inches in each direction during the STS testing.

D. CONCLUSION: The JDAM load blocking and bracing procedure, as tested, satisfactorily completed testing.

PART 6 – DRAWINGS

The following drawing represents the load configuration that was subjected to the test criteria.

APPROVED BY
BUREAU OF EXPLOSIVES

DATE _____

LOADING AND BRACING* IN END OPENING ISO CONTAINERS OF JOINT DIRECT ATTACK MUNITION (JDAM), PACKED 2 PER CNU-589/E SHIPPING AND STORAGE CONTAINER

INDEX

ITEM

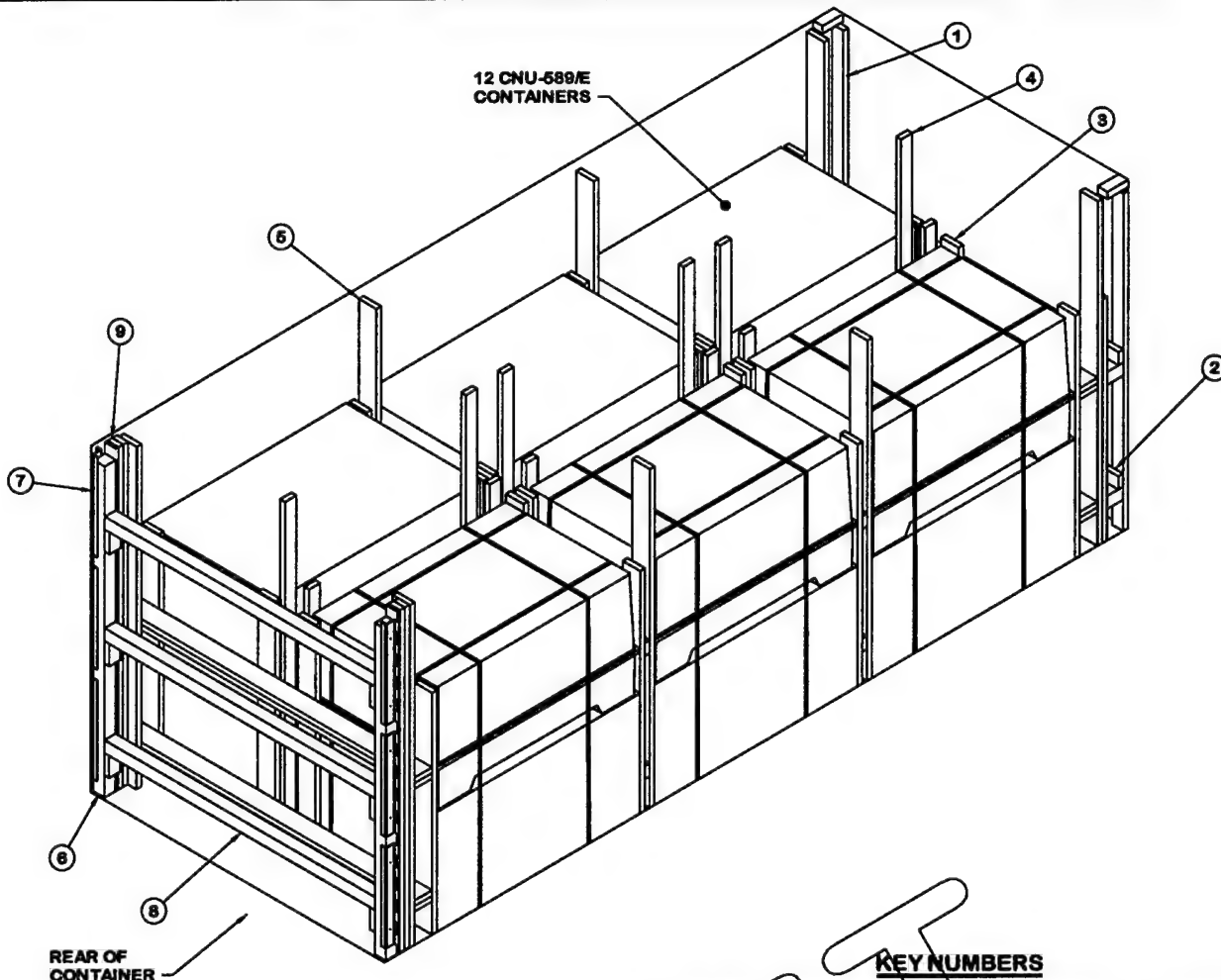
PAGE(S)

TYPICAL LOADING PROCEDURES	2
GENERAL NOTES AND MATERIAL SPECIFICATIONS	3
CNU-589/E CONTAINER DETAILS	4
DETAILS	4-6
LESS-THAN-FULL-LOAD-PROCEDURE	7

- * LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS.

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY OPERATIONS SUPPORT COMMAND	CAUTION: VERIFY PRIOR TO USE AT WWW.DAC.ARMY.MIL THAT THIS IS THE MOST CURRENT VERSION OF THIS DOCUMENT. THIS IS PAGE 1 OF 8.					
APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND	DO NOT SCALE		AUGUST 2003			
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	TRANSPORTATION ENGINEERING DIVISION					
	VALIDATION ENGINEERING DIVISION	TESTED	CLASS	DIVISION	DRAWING	FILE
	LOGISTICS ENGINEERING OFFICE		19	48	8788	SP15K10
U.S. ARMY DEFENSE AMMUNITION CENTER	PROJECT <u>SP 487-03</u>					



ISOMETRIC VIEW

BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
2" X 4"	290	193
2" X 6"	231	231
4" X 4"	40	85
NAILS	NO. REQD	POUNDS
10d (3")	390	6
12d (3-1/4")	12	1/4
UNIVERSAL LOAD RETAINERS - - -	6 REQD - - -	39 LBS

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
CNU-589/E CONTAINER - -	12 - - -	7,428 LBS
DUNNAGE - - - - -	- - - - -	995 LBS
CONTAINER - - - - -	- - - - -	4,700 LBS
TOTAL WEIGHT - - - - -		13,123 LBS (APPROX)

KEY NUMBERS

- ① STRUT ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 4. AFTER THE END BLOCKING ASSEMBLY IS INSTALLED, NAIL THROUGH THE BUFFER PIECE OF THE END BLOCKING ASSEMBLY STRUT INTO THE VERTICAL PIECE OF THE STRUT ASSEMBLY W/4-10d NAILS.
- ② SPREADER PIECE, 2" X 4" BY INSIDE CONTAINER WIDTH MINUS 1" (REF: 7'-7") (2 REQD). NAIL TO THE VERTICAL PIECES OF THE STRUT ASSEMBLY W/2-10d NAILS AT EACH END.
- ③ END BLOCKING ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 4.
- ④ CRIB FILL ASSEMBLY (3 REQD). SEE DETAIL ON PAGE 5. POSITION BETWEEN ADJACENT 2-HIGH STACKS OF CNU-589/E CONTAINERS AS SHOWN.
- ⑤ SEPARATOR GATE (2 REQD). SEE DETAIL ON PAGE 5. POSITION BETWEEN ROWS OF CNU-589/E CONTAINERS AS SHOWN.
- ⑥ DOOR POST VERTICAL (2 REQD). SEE DETAIL ON PAGE 5, "DETAIL A" ON PAGE 6 AND GENERAL NOTE "L" ON PAGE 3.
- ⑦ UNIVERSAL LOAD RETAINER (6 REQD, 3 PER SIDE). NAIL THROUGH THE HOLES INTO THE DOOR POST VERTICAL W/2-10d NAILS. SEE DEPARTMENT OF ARMY DRAWING DA-116, "DETAIL A" ON PAGE 6, AND GENERAL NOTE "L" ON PAGE 3.
- ⑧ DOOR SPANNER, 4" X 4" MATERIAL CUT TO A LENGTH THAT WILL PROVIDE A DRIVE FIT (REF: 7'-1-1/4") (3 REQD). TOENAIL TO THE DOOR POST VERTICAL W/2-12d NAILS AT EACH END. SEE "BEVEL CUT" DETAIL ON PAGE 5.
- ⑨ FILL MATERIAL 4" WIDE BY 6'-10" LONG MATERIAL (AS REQD). NAIL THE FIRST PIECE TO THE REAR BLOCKING ASSEMBLY W/8 NAILS OF APPROPRIATE SIZE (10d FOR 2" THICK MATERIAL). NAIL EACH ADDITIONAL PIECE TO THE PREVIOUS PIECE IN A SIMILAR MANNER. NOTE: MULTIPLE PIECES MAY BE LAMINATED TOGETHER FIRST AND THEN TOENAILED TO THE END BLOCKING ASSEMBLY.

(GENERAL NOTES CONTINUED)

M. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4MM AND ONE POUND EQUALS 0.454 KG.

N. MAXIMUM LOAD WEIGHT CRITERIA:

THE MAXIMUM LOAD WEIGHTS ARE CONTROLLED BY EQUIPMENT CAPABILITY FACTORS. ALTHOUGH THE HEAVIEST MAXIMUM LOADS ARE DELINEATED IN THE LOAD VIEWS, PROVISIONS ARE INCLUDED WITHIN THIS DRAWING SO THAT THE BASIC LOADS CAN BE ADJUSTED TO SATISFY A LESSER QUANTITY OF LADING UNITS. DEPENDING ON TRANSPORTATION ROUTING, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY "WEIGHT LAWS" OF CERTAIN STATES. ALSO, IT MAY BE NECESSARY TO REDUCE THE LOAD WEIGHT TO SATISFY OTHER WEIGHT RESTRICTIONS IMPOSED ON THE INTERMODAL CONTAINER SYSTEM.

O. REQUIREMENTS CITED WITHIN THE ASSOCIATION OF AMERICAN RAILROADS (AAR) INTERMODAL LOADING GUIDE APPLY WHEN THE SHIPMENT MOVES BY TRAILER/CONTAINER-ON-FLATCAR (TICOFC). SPECIAL TICOFC NOTES FOLLOW:

1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN TOFC SERVICE.
2. THE LOAD LIMIT OF A TICOFC RAILCAR MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.

P. THE QUANTITY OF CONTAINERS SHOWN IN THE LOAD ON PAGE 2 MAY BE REDUCED FOR SHIPMENT, IF DESIRED. SEE THE DETAIL ON PAGE 7. WHEN A CONTAINER IS TO BE LOADED WITH A REDUCED QUANTITY OF LADING UNITS, THE LENGTH-WISE CENTER OF GRAVITY OF THE LOAD MUST BE WITHIN 12", IN EITHER DIRECTION, OF THE MID-POINT OF THE CONTAINER.

Q. RECOMMENDED SEQUENTIAL LOADING PROCEDURES:

1. PREFABRICATE TWO STRUT ASSEMBLIES, TWO END BLOCKING ASSEMBLIES, THREE CRIB FILL ASSEMBLIES, AND TWO DOOR POST VERTICALS.
2. INSTALL THE TWO STRUT ASSEMBLIES, THE TWO SPREADER PIECES, AND ONE END BLOCKING ASSEMBLY.
3. LOAD TWO STACKS OF 2-HIGH CNU-589/E CONTAINERS.
4. INSTALL ONE CRIB FILL ASSEMBLY.
5. INSTALL ONE SEPARATOR GATE.
6. REPEAT STEPS 3, 4, AND 5.
7. REPEAT STEPS 3 AND 4.
8. INSTALL THE REMAINING END BLOCKING ASSEMBLY, THE TWO DOOR POST VERTICAL ASSEMBLIES, AND THE SOLID FILL MATERIAL.
9. INSTALL THE THREE DOOR SPANNER PIECES.

MATERIAL SPECIFICATIONS

LUMBER	---	SEE TM 743-200-1 (DUNNAGE LUMBER) AND VOLUNTARY PRODUCT STANDARD PS 20.
NAILS	---	ASTM F1667; COMMON STEEL NAIL (NLCMS OR NLCMS).
PLYWOOD	---	COMMERCIAL ITEM DESCRIPTION A- A-55057, INDUSTRIAL PLYWOOD, INTERIOR WITH EXTERIOR GLUE, GRADE C-D, IF SPECIFIED GRADE IS NOT AVAILABLE, A BETTER INTERIOR OR EXTERIOR GRADE MAY BE SUBSTITUTED.
STEEL, STRUCTURAL	---	ASTM A36; 36,000PSI MINIMUM YIELD OR BETTER.

GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AUGMENTS TM 743-200-1 (CHAPTER 5).

B. THE SPECIFIED OUTLOADING PROCEDURES ARE APPLICABLE TO LOADS OF JOINT DIRECT ATTACK MUNITION (JDAM) GUIDANCE KITS PACKED IN CNU-589/E CONTAINERS. SUBSEQUENT REFERENCE TO CONTAINER HEREIN MEANS THE CONTAINER WITH AMMUNITION ITEMS. SEE PAGE 4 FOR DETAILS OF THE CONTAINER. CAUTION: REGARDLESS OF THE QUANTITY OF CONTAINERS TO BE SHIPPED, THE "MAXIMUM GROSS WEIGHT" OF THE END OPENING ISO CONTAINER MUST NOT BE EXCEEDED.

C. THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20' LONG BY 8' WIDE BY 8'-8" HIGH END OPENING ISO CONTAINER WITH INSIDE DIMENSIONS OF 19'-4" LONG BY 92" WIDE BY 93" HIGH, WITH A MAXIMUM GROSS WEIGHT OF 52,910 POUNDS. OLDER/OTHER CONTAINERS MAY HAVE A TOTAL INSIDE HEIGHT OF 95", BUT A CLEAR HEIGHT UNDER THE ROOF BOWS OF 93". VERIFY INSIDE CONTAINER HEIGHT PRIOR TO FABRICATING DUNNAGE. THE LOAD IS DESIGNED FOR TRAILER/CONTAINER-ON-FLATCAR (TICOFC) SHIPMENT, HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.

D. WHEN LOADING PALLET UNITS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE DUNNAGE ASSEMBLIES). THE UNBLOCKED SPACE ACROSS THE WIDTH OF A LOAD BAY IS NOT TO EXCEED 1-1/2". EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE VERTICAL PIECES ON THE CRIB FILL ASSEMBLIES. NAIL EACH ADDITIONAL PIECE W/ APPROPRIATELY SIZED NAIL EVERY 12". ADDITIONALLY, THE LENGTH OF THE STRUTS IN THE CRIB FILL ASSEMBLIES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE SIZE OF THE PALLET UNIT.

E. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" THICK BY 5-1/2" WIDE.

F. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO JOINTS OF DUNNAGE ASSEMBLIES OR WHEN LAMINATING DUNNAGE. ADDITIONALLY, THE NAILING PATTERN FOR AN UPPER PIECE OF LAMINATED DUNNAGE WILL BE ADJUSTED AS REQUIRED SO THAT A NAIL FOR THAT PIECE WILL NOT BE DRIVEN THROUGH ONTO OR RIGHT BESIDE A NAIL IN A LOWER PIECE.

G. IN SOME CONTAINERS THERE IS A SLOT AT THE CORNERS OF THE FORWARD WALL. PIECES OF DUNNAGE MATERIAL MUST BE LAMINATED TO THE BUFFER PIECES ON THE FORWARD BLOCKING ASSEMBLY TO PROVIDE A FLAT SURFACE FOR THE BUFFER PIECES. A PIECE OF 2" X 4", 2" X 3" OR A SPECIAL WIDTH PIECE CUT-TO-FIT CAN BE USED. THIS FILL PIECE WILL BE NAILED WITH ONE APPROPRIATELY SIZED NAIL EVERY 12". NOTE THAT SOME CONTAINERS ARE EQUIPPED WITH "TIE-BARS" IN THE CORNER SLOT, WHICH PRECLUDE THE USE OF A FULL HEIGHT FILL PIECE. WHEN "TIE-BARS" ARE PRESENT, THE FILL PIECE MUST BE INSTALLED IN SEGMENTS DESIGNED TO FIT BETWEEN THE "TIE-BARS" VERTICALLY. THE FILL PIECE(S) IS NOT REQUIRED WHEN THE CORNER PORTIONS OF THE CONTAINER FORWARD WALL ARE SMOOTH AND FLAT. DO NOT ALLOW ANY DUNNAGE ASSEMBLY TO CONTACT THE CONTAINER FORWARD WALL. ONLY THE CORNER POSTS OF THE CONTAINER SHOULD BE USED FOR FORWARD LONGITUDINAL BLOCKING.

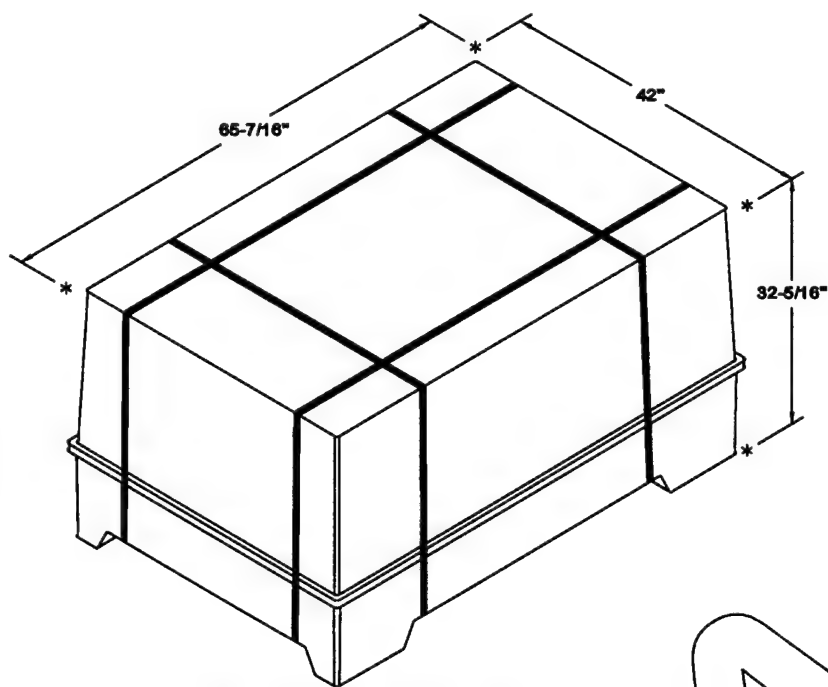
H. WHETHER A CONTAINER IS FULL OR IS LOADED WITH A REDUCED QUANTITY OF LADING UNITS, THE LENGTHWISE CENTER OF GRAVITY OF THE LOAD MUST BE WITHIN 12", IN EITHER DIRECTION, OF THE MID-POINT OF THE CONTAINER.

J. CAUTION: DO NOT NAIL DUNNAGE MATERIAL TO THE CONTAINER WALLS OR FLOOR. ALL NAILING WILL BE WITHIN THE DUNNAGE.

K. PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS THE SIDEWALL, HAVE NOT BEEN SHOWN IN THE LOAD VIEWS FOR CLARITY PURPOSES.

L. SIX UNIVERSAL LOAD RETAINERS ARE DEPICTED IN THE LOAD ON PAGE 2. SIX UNIVERSAL LOAD RETAINERS ARE REQUIRED WHEN LOADING THE CNU-589/E CONTAINERS MORE THAN ONE LAYER HIGH. WHEN LOADING SIX OR LESS CONTAINERS (ONE LAYER HIGH) FOUR UNIVERSAL LOAD RETAINERS ARE REQUIRED. REFER TO DEPARTMENT OF THE ARMY DRAWING DA-116 FOR DETAILS OF THE UNIVERSAL LOAD RETAINER CONSTRUCTION, INSTALLATION TO THE DOOR POST VERTICAL, PLACEMENT INTO THE CONTAINER, AND FOR OTHER METHODS OF REAR OF LOAD RESTRAINT.

(CONTINUED AT LEFT)



CNU-589/E CONTAINER WITH JDAM

CNU-589/E CONTAINER WITH 2 EACH GUIDANCE SETS
 GROSS WEIGHT ----- 619 LBS (APPROX)
 CUBE ----- 51.4 CUBIC FEET (APPROX)

BUFFER PIECE, 2" X 4" BY
 INSIDE CONTAINER HEIGHT
 MINUS 1" (REF: 7'-7") (1 REQD).
 NAIL TO THE STRUTS W/2-10d
 NAILS AT EACH JOINT.

INDICATES FILL
 PIECE, SEE GEN-
 ERAL NOTE "G"
 ON PAGE 3.

VERTICAL PIECE,
 2" X 4" X 65"
 (1 REQD). NAIL
 TO THE STRUTS
 W/2-10d NAILS
 AT EACH JOINT.

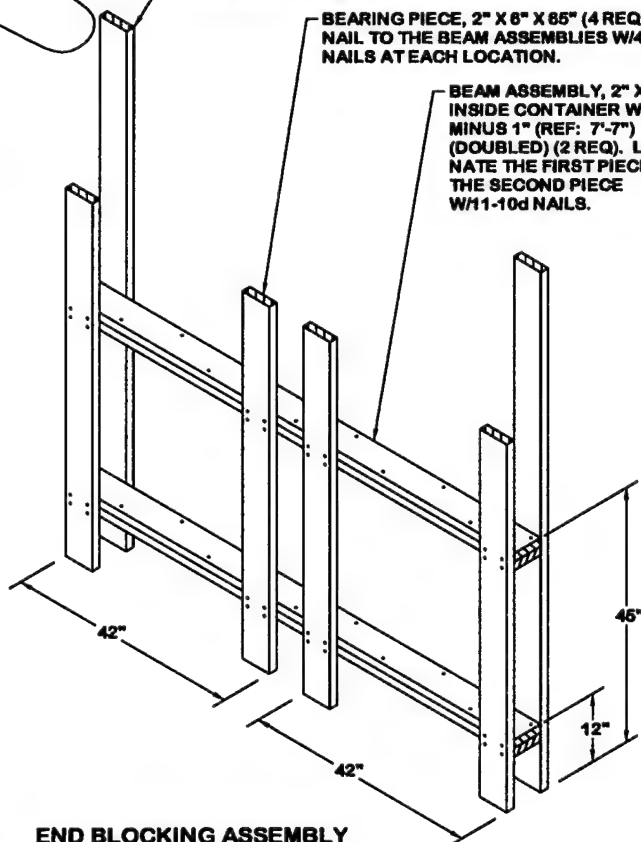
STRUT ASSEMBLY

STRUT, 4" X 4"
 X 9" (2 REQD).

BUFFER PIECE, 2" X 6" BY INSIDE CONTAINER HEIGHT
 MINUS 1" (REF: 7'-8") (2 REQD). NAIL TO THE BEAM
 ASSEMBLIES W/4-10d NAILS AT EACH LOCATION.

BEARING PIECE, 2" X 6" X 65" (4 REQD).
 NAIL TO THE BEAM ASSEMBLIES W/4-10d
 NAILS AT EACH LOCATION.

BEAM ASSEMBLY, 2" X 6" BY
 INSIDE CONTAINER WIDTH
 MINUS 1" (REF: 7'-7")
 (DOUBLED) (2 REQ). LAMI-
 NATE THE FIRST PIECE TO
 THE SECOND PIECE
 W/11-10d NAILS.



END BLOCKING ASSEMBLY

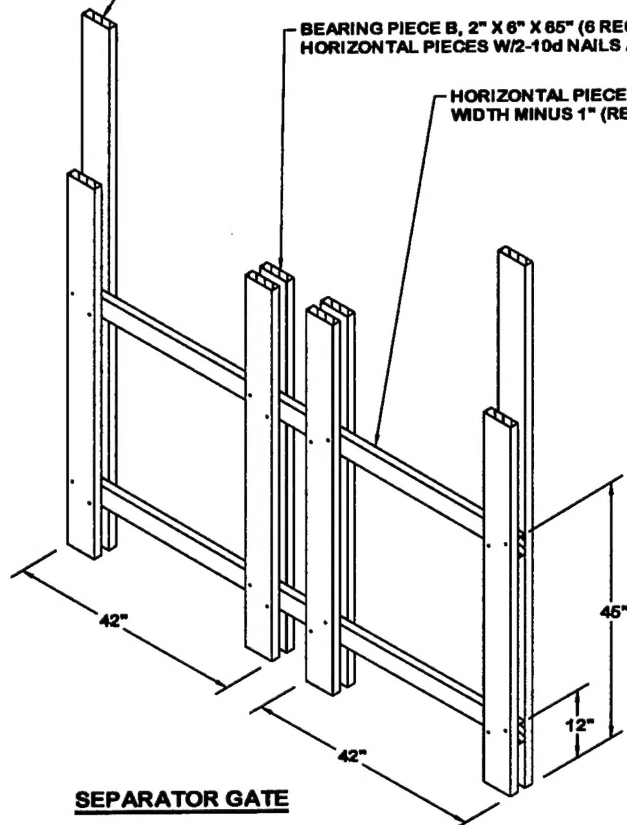
BEARING PIECE A, 2" X 6" BY INSIDE CONTAINER HEIGHT MINUS 1" (REF: 7'-8") (2 REQD). NAIL TO THE HORIZONTAL PIECES W/2-10d NAILS AT EACH LOCATION.

BEARING PIECE B, 2" X 6" X 65" (6 REQD). NAIL TO THE HORIZONTAL PIECES W/2-10d NAILS AT EACH LOCATION.

HORIZONTAL PIECE, 2" X 6" BY INSIDE CONTAINER WIDTH MINUS 1" (REF: 7'-7") (2 REQ).

VERTICAL PIECE, 4" X 4" BY INSIDE CONTAINER HEIGHT MINUS 1" (REF: 7'-6") (1 REQD).

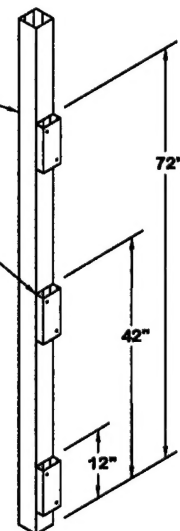
SPANNER LEDGER, 2" X 4" X 6" (3 REQD). NAIL TO THE VERTICAL PIECE W/2-10d NAILS.



SEPARATOR GATE

DOOR POST VERTICAL

NOTE: FOR A ONE HIGH LOAD, ELIMINATE THE TOP SPANNER LEDGER.

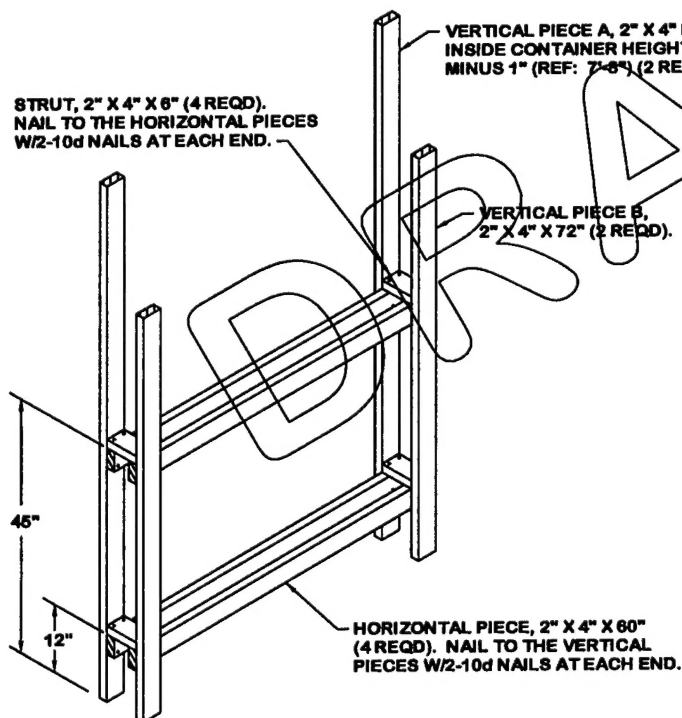


STRUT, 2" X 4" X 6" (4 REQD). NAIL TO THE HORIZONTAL PIECES W/2-10d NAILS AT EACH END.

VERTICAL PIECE A, 2" X 4" BY INSIDE CONTAINER HEIGHT MINUS 1" (REF: 7'-6") (2 REQD).

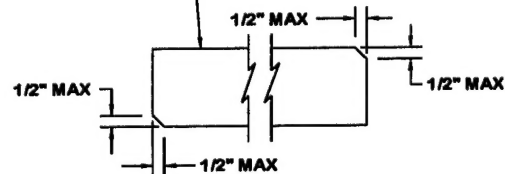
VERTICAL PIECE B, 2" X 4" X 72" (2 REQD).

HORIZONTAL PIECE, 2" X 4" X 60" (4 REQD). NAIL TO THE VERTICAL PIECES W/2-10d NAILS AT EACH END.



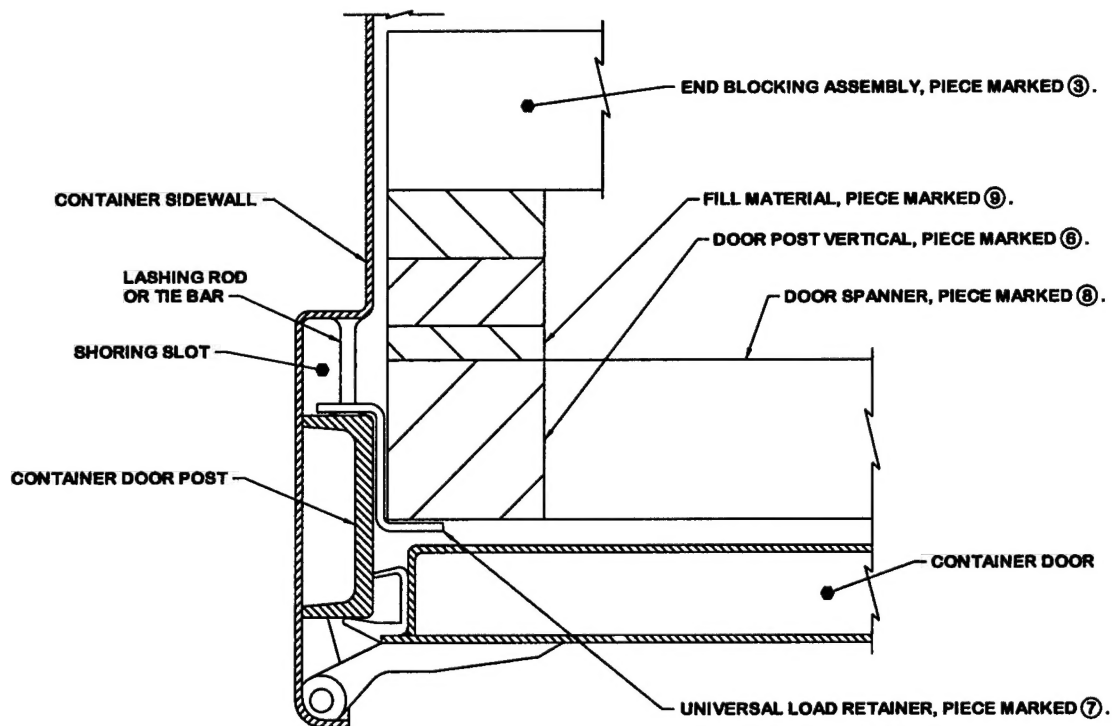
CRIB FILL ASSEMBLY

INDICATES A STRUT.



BEVEL-CUT

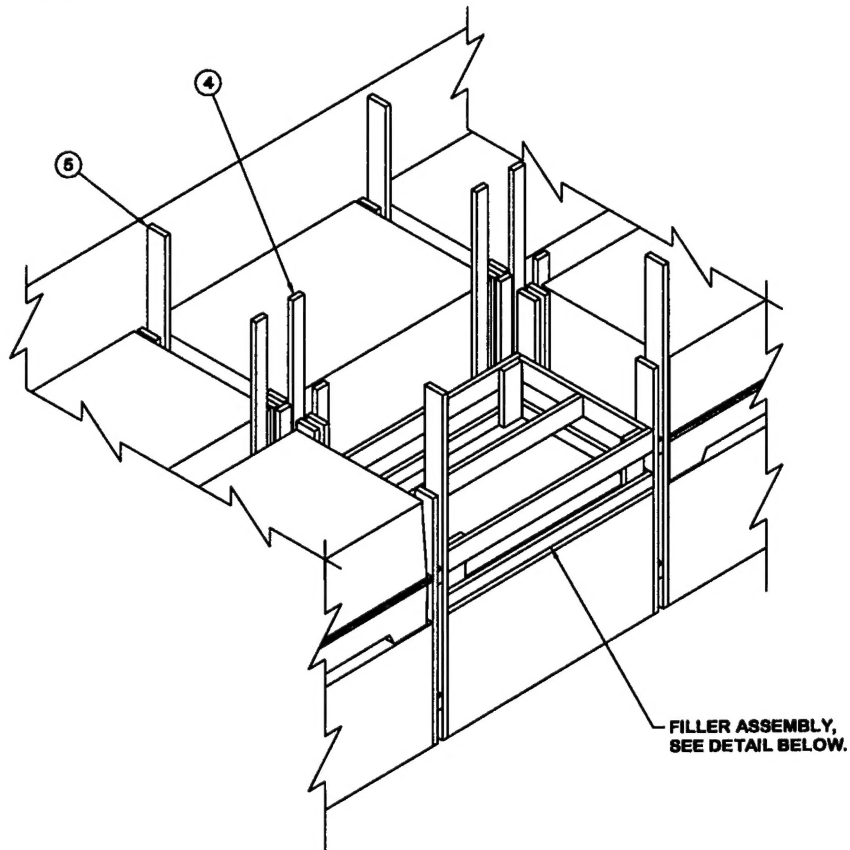
IF DESIRED, EACH END OF A STRUT MAY BE BEVEL-CUT AS SHOWN ABOVE TO FACILITATE THE ACHIEVEMENT OF A TIGHT FIT BETWEEN THE DOOR POST VERTICALS AND THE DOOR SPANNERS.



DETAIL A

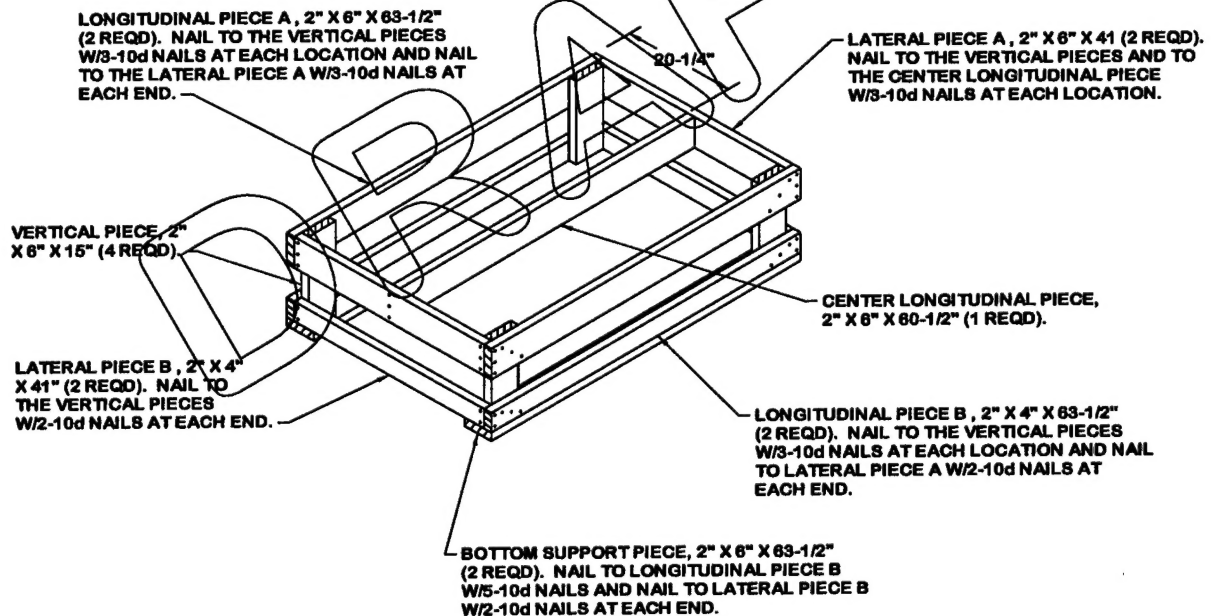
A PARTIAL PLAN VIEW OF THE LEFT REAR PORTION OF THE CONTAINER IS SHOWN DEPICTING THE PROPER POSITION OF THE UNIVERSAL LOAD RETAINER AND ADJACENT DUNNAGE PIECES. SEE DEPARTMENT OF ARMY DRAWING DA-116 FOR ADDITIONAL DETAILS AND PROCEDURES FOR OTHER TYPES OF RETAINERS THAT MAY BE USED FOR REAR-OF-LOAD RESTRAINT.

DRAFT



LESS-THAN-FULL-LOAD PROCEDURE

THE DETAIL ABOVE DEPICTS A BLOCKING METHOD TO BE USED IN A LESS-THAN-FULL CONTAINER LOAD (LESS THAN 12 UNITS). KEY NUMBERS REFER TO KEY NUMBERS ON PAGE 2. SEE GENERAL NOTE "P" ON PAGE 3.



FILLER ASSEMBLY

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